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ABSTRACT

Questions concerning the ontogeny of the planning process and its role in the regulation of behavior have been markedly absent from the literature. The present study examines the planning done during solitary play by middle-class children from four public nursery schools in Athens, Greece. One hundred preschool children in five age groups (42, 48, 54, 60, and 66 months) were individually observed in two sessions of solitary play. One session involved constructive play, for which wooden blocks were provided. The other session focused on dramatic play involving a plastic house and an assortment of plastic dolls and vehicles. A Greek version of the Stanford-Binet was also administered to each child. Three features of play were observed: temporal aspects, such as duration and persistence; complexity and coherence of organization; and evidence of advance planning. Results showed that complexity and coherence increased with age for both types of play, but persistence and planning increased with age only in dramatic play. An attempt was made to assess the role of advance planning in directing the quality of solitary play. The two hypotheses considered were that (1) advance planning directs the quality of play, and (2) advance planning, along with qualitative aspects of play, is a function of the cognitive level of the child. It was not possible to choose between these two hypotheses on the basis of present evidence. (Author/BN)

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Executive Control at an Early Age: Advance Planning in Solitary Play

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Abstract

One hundred preschool children in five age groups, 42, 48, 54, 60, and 66 months, were individually tested in two sessions of solitary play: with wooden blocks, CP, and with realistic toys, DP. The development of three aspects of play behavior was analyzed: temporal aspects, organizational features, and evidence of advance planning. There was greater evidence of development in DP than in CP, in part because a higher level of CP was manifest in the youngest children, especially among boys. An attempt was made to assess the role of advance planning in directing the quality of solitary play. Two hypotheses were considered: a) that advance planning directs the quality of play; b) that it, along with qualitative aspects of play, is a function of cognitive level of the child, i.e., MA. It was not possible to choose between these two hypotheses on the basis of present evidence.

Executive Control at an Early Age:
Advance Planning in Solitary Play

Although planning is an important feature of everyday life, it is a feature that has received remarkably little attention in the laboratory. Questions concerning the ontogeny of the planning process and its role in the regulation of behavior have been marked by their absence in the literature. The recent rise of interest in metacognition (Brown, Bransford, Ferrara, & Campione, 1983), and especially of what has come to be known as the "executive control" component of metacognition, promise a remediation of this omission, but, to date, that promise remains unfulfilled. The present study attempts to provide information on the early origins of planning in a natural context for the young child, the area of solitary play. McCune (Nicolich, 1977; McCune-Nicolich, 1981) has noted the origin of planning in intentional pretend play, as evidenced by search for a toy or announcement of intent, during the period from 18 - 26 months. The present study examines the unfolding of that origin in pre-school children engaged in solitary play with blocks and with realistic toys as manifest in both verbal and nonverbal evidence of prior planning. In addition to the goal of describing the growth of planning in two solitary play contexts, we also attempt to determine the consistency of planning across play contexts and to relate it to play quality and to cognitive growth more generally (as indexed by performance on the Stanford-Binet). Solitary play was deliberately chosen as a vehicle in order to remove possible confounding effects

of the influence of another child which inevitably arise in social play.

Method

Subjects. Fifty girls and fifty boys from four public nursery schools in three areas of Athens, Greece, populated primarily by middle-class families, served as subjects. The parents of the children were public or private sector employees or proprietors of small businesses. With few exceptions (5%) the mothers worked full- or part-time. The families were intact for 89% of the children. The children comprised five age groups of 10 boys and 10 girls each in the age ranges of 42, 48, 54, 60, and 66 months ± 1.5 months. A Greek version of the Stanford-Binet was administered to each child within one week of participation by one of two examiners uninformed as to the purpose of the study. There were no significant differences among groups with respect to IQ ($F(4,90) = 1.24$, $p = .30$) but gender differences, in favor of girls, approached significance ($F(1,90) = 3.68$, $p = .06$).

Experimental setting and material. Each child was tested in a corner of the school's dining room at a table containing the play material. The E sat near the video-taping equipment about 4 - 5 meters away from the child.

Two kinds of play material were used: For constructive play, CP, there were 30 wooden Baufix blocks varying in size, shape, and color; for dramatic play, DP, a Fisher-Price town block consisting of a two-story plastic house with four furnished rooms and an

attached garage was used. Twelve dolls representing men, women and children, and two toy vehicles, a truck and a car, were arranged in front of the house. A fire-engine with three toy firemen was placed at the side of the house.

Procedure. The child was conducted to the play room and instructed to play with the toys on the table for as long as desired while E did some work. Each child served in two consecutive sessions of at least 10 minutes of CP and 6 minutes of DP. The order of sessions was counterbalanced. Each session continued until the child indicated that he/she was finished.

Results

Experimental measures. Three classes of parallel measures were collected reflecting a) Temporal aspects of play (Session duration, proportion of session devoted to toy appropriate play, and longest uninterrupted episode -- persistence); b) Complexity and coherence of organization (number of organized units -- themes/structures; number of components of unit, complexity; and a rating of thematic/structural coherence); and c) Evidence of advance planning as manifest verbally (announcement of next action or announcement of next theme/structure) or nonverbally (search for toy/block, or proceeding in a logical order). A total summary of advance planning was also used. Inter-rater reliability for all measures was high: r = .93, r = .92 for temporal aspects ; r = .87, r = .89 for organizational measures; and r = .87, r = .90 for evidence of advance planning, all for DP and CP respectively.

Age changes in temporal and organizational aspects of play. Although the younger age groups tended to have somewhat shorter play sessions, the total session duration was relatively constant across age with an overall mean of 6.76 minutes for CP and 10.26 for DP. What is more remarkable is the proportion of session devoted to toy appropriate activity. In CP proportion of time on does not increase significantly with age but boys devote a significantly higher proportion of the session to construction than do girls ($F1,90$) = 5.07, $p < .03$). For DP, on the other hand, there is a significant increase with age in time on ($F(4,90) = 6.71$, $p < .0001$) and gender differences are not statistically significant. Persistence, the proportion of time spent in longest uninterrupted episode, was also remarkably high showing no significant age change for CP. Overall, boys showed greater persistence than girls ($F(1,90) = 4.78$, $p < .05$) but the magnitude of the difference declines with age as shown by a significant age x gender interaction, $F(4,90) = 2.49$, $p < .05$. For DP, on the other hand, persistence increases with age ($F(1,90) = 17.94$, $p < .0001$) while gender differences are not statistically significant. These effects are shown in Figures 1 and 2.

Insert Figures 1 and 2 about here

With respect to the organization of play within a session, two measures will be discussed, complexity (COM) and coherence (COH). COM reflects the maximum number of different dramatic activities in

the longest theme of DP, or the maximum number of structural elements in the largest structure of CP. An example of a six-component theme is: call fire department, have engine come, extinguish fire, take injured to hospital, return to fire house, firemen rest. A six-component structure might be a house consisting of four walls, a door, and a roof. Coherence was rated on a five point scale from 0 (no central theme or logical sequence of schemes in DP; no identifiable structure in CP) to 2 (for a logically ordered theme with a beginning and end, or a recognizable structure of connected parts). In DP complexity increased (see Table 1) almost linearly with age, $F(4,90) = 4.50$, $p < .01$; there were no gender differences. Comparable age trends obtain for CP; age differences are significant, $F(4,90) = 5.17$, $p < .001$, while gender differences are not. With respect to coherence of organization (Table 2) there is a significant increase with age ($F(4,90) = 5.54$, $p < .001$ for CP and $F((4,90) = 5.00$, $p < .001$ for DP). There were no gender differences for DP but for CP the constructions by boys were significantly more coherent than those of girls, $F(1,90) = 6.68$, $p < .01$.

Evidence of advance planning. The total number of instances of advance planning by boys and girls in each play context is shown in Figure 3, with a break-down into verbal and nonverbal instances in Figure 4. Of the 100 children observed only one child, a four-year old in DP, showed no evidence of advance planning. The overall frequency of advance planning shows a significant increase with age

only in DP, $F(4,90) = 3.62$, $p < .01$, with no gender differences. For CP on the other hand, there are no significant age differences, $F(4,90) = 1.71$, but gender differences are significant in favor of boys, $F(1,90) = 4.04$, $p < .05$. Verbal indications of advance planning tend to be low in both play contexts where neither age, gender, or interaction effects are statistically significant. For nonverbal manifestations, on the other hand, there is a statistically significant age increase in DP, $F(4,90) = 3.95$, $p < .01$. In terms of the number of children who gave nonverbal evidence of advance planning, all did so in both CP and DP except for one four-year old in DP. For verbal manifestations, the incidence was lower: the number of children at each age level displaying at least one instance was 11, 14, 19, 17, 18 with increasing age in DP; and 9, 16, 12, 16, 17 for CP. The evidence on number of children evidencing planning, thus tends to parallel the evidence for frequency of occurrence.

Insert Figures 3 and 4 about here

Relation of advance planning to other measures. While advance planning shows an increase in frequency with age in DP, but not CP, it is clearly present even among the youngest children. One may ask to what extent it is characteristic of the context, of the child, and what role it might play in the determination of other aspects of play activity. Some evidence with respect to each of these

questions is available in the present data although all of the evidence is correlational in nature. With respect to contextual consistency, the correlation of verbal and nonverbal measures of advance planning within a play session is $\underline{r}$ = .64 for DP and $\underline{r}$ = .33 for CP. Correlations of each component to an overall measure of advance planning are higher (.89 and .92 for verbal and nonverbal in DP: .65 and .92 in CP) but more difficult to interpret since each component is a part of the total. With respect to the within child consistency of advance planning across play contexts, relevant correlations are shown in Table 3 for advance planning along with other measures of quality of play cited earlier. For the group as a whole, the across session consistency is at least as high as for measures of play organization (complexity and coherence), and somewhat more when the effect of MA differences is partialled out. When boys and girls are examined separately, however, the pattern of results becomes more complicated with greater evidence for across task consistency in advance planning on the part of girls than for boys; for boys it is complexity and persistence that show the greatest across task consistency. This finding may be, at least in part, attributable to the lesser variation among boys in measures of constructive play (i.e., a possible truncation of range).

Insert Table 3 about here

To what extent does advance planning direct the other aspects of quality of play? One answer to that question is provided by the

correlations of Table 4 in which advance planning, and its verbal and nonverbal component measures are correlated with two temporal measures and two organizational measures for CP and for DP. In the case of CP, which normally evokes little verbalization in any event, the correlations with nonverbal and total measures of advance planning are all significant at the .001 level although they are of moderate magnitude. In the case of DP, on the other hand, all correlations are statistically significant at or beyond the .001 level of confidence and of greater magnitude. Here it would appear that advance planning does play a role in both temporal and organizational aspects of the quality of play. This conclusion, however, must be tempered by the finding of high correlations among the measures of quality of play. First, it should be noted that temporal measures are highly intercorrelated with each other (r = .80 for CP; r = .84 for DP) as are organizational measures (r = .78 for CP; r = .81 for DP). Of greater concern is the fact that correlations among temporal and organizational measures range from .40 (for coherence and persistence) to .55 (for coherence and time on) in CP and from .72 (for complexity and persistence) to .80 (for coherence and time on) in DP. The orders of magnitude in each case are equivalent to those obtained for the relation of measures of play quality to advance planning.

Insert Tables 4 and 5 about here

An alternative explanation for the findings above is that all measures are themselves a reflection of the cognitive level of the child. Appropriate evidence with which to assess that hypothesis is summarized in Table 5 which shows the correlation of measures of advance planning, and temporal and organizational measures of play quality with MA in each play context. Here, again, most correlation values are statistically significant at the .001 level of confidence and of roughly comparable orders of magnitude. The differences in magnitude between CP and DP are, however, reduced, especially in the case of girls, and there is some suggestion that MA is of less importance in determination of the temporal aspects of play, especially for CP in boys. One possible reconciliation of the data in Tables 4 and 5 is that MA effects moderate the relation of advance planning and other aspects of the quality of play. A more direct test of the relative contributions of MA and advance planning *per se* upon other aspects of play quality might be provided by a path analysis of the data. That is not available at the present time.

Discussion

Data have been presented for five age groups of children engaged in solitary play with blocks, CP, and in dramatic play with realistic toys, DP. Three aspects of play behavior were examined: temporal aspects, organizational aspects, and evidence of advance planning. It was shown that there is development with age in all three aspects, more so in DP than in CP. It was further shown that

there is some across situational consistency in advance planning, at least in DP, and that manifestation of advance planning is correlated with other indices of play quality (to a greater extent in DP than in CP). Two hypotheses concerning the role of advance planning in solitary play were considered: a) that it directs the quality of play, or b) that it, along with other indices of quality of play, is determined by cognitive level of the child. It was not possible to select among these hypotheses on the basis of available evidence; both are tenable.

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Table 1

Group Means for number of thematic (DP) and structural (CP) components and number of blocks per structure (CP) (Standard Deviations in parentheses)

DP Components	Age Groups 3-6	4-0	4-6	5-0	5-6	Gender Means
Boys	4.80 (3.01)	8.20 (5.09)	10.40 (2.72)	10.60 (3.50)	11.00 5.94)	9.00 (4.69)
Girls	6.50 (2.84)	6.80 (4.80)	8.20 (4.08)	10.50 (5.78)	10.00 (5.14)	8.40 (4.74)
Age Means	5.65 (2.98)	7.50 (4.87)	9.30 (3.56)	10.55 (4.65)	10.50 (5.43)	
CP Components						
Boys	2.60 (1.84)	4.20 (1.55)	4.80 (1.32)	4.70 (2.11)	4.70 (1.83)	4.20 (1.87)
Girls	2.60 (.84)	4.10 (2.73)	2.90 (1.20)	5.00 (2.98)	5.60 (2.17)	4.04 (2.37)
Age Means	2.60 (1.39)	4.15 (2.16)	3.85 (1.56)	4.85 (2.52)	5.15 (2.00)	
Number of Blocks						
Boys	11.80 (9.19)	13.20 (7.36)	17.20 (9.35)	16.00 (10.87)	17.70 (7.99)	15.18 (8.96)
Girls	8.80 (5.57)	13.10 (11.40)	9.80 (9.77)	20.40 (11.68)	12.20 (8.53)	12.86 (10.12)
Age Means	10.30 (7.55)	13.15 (9.34)	13.50 (10.05)	18.20 (11.21)	14.95 (8.51)	

Table 2

Group Mean ratings of thematic (DP) and structural (CP) Coherence (Standard Deviations in parentheses)

DP	Age Groups 3-6	4-0	4-6	5-0	5-6	Gender Means
Boys	.50 (.53)	1.15 (.75)	1.50 (.47)	1.55 (.44)	1.25 (.68)	1.19 (.68)
Girls	.90 (.70)	.85 (.82)	1.05 (.72)	1.55 (.68)	1.40 (.66)	1.15 (.74)
Age Means	.70 (.64)	1.00 (.78)	1.28 (.64)	1.55 (.56)	1.32 (.65)	
CP						
Boys	.70 (.63)	1.25 (.63)	1.50 (.47)	1.35 (.53)	1.65 (.47)	1.29 (.62)
Girls	.65 (.41)	.95 (.68)	.75 (.63)	1.25 (.59)	1.35 (.67)	.99 (.64)
Age Means	.68 (.52)	1.10 (.66)	1.12 (.66)	1.30 (.55)	1.50 (.58)	

Table 3

Correlation Coefficients[1] for DP and CP Scores on Parallel Measures (i.e.) Across Situation Consistency) and Partial Correlations With MA Removed for Boys, Girls, and Total Sample.

	Boys		Girls		Total	
Measure	r	part. r	r	part. r	r	part. r
%Appropriate	39**	30*	46***	32*	42***	32***
Persistence	38**	36**	34*	09	34***	24*
Complexity	61***	45**	47***	25*	53***	35***
Coherence	59***	27*	57***	35**	57***	34***
Adv. Plan.	44**	23	60***	45**	53***	38***
Non Verbal AP	49***	32*	60***	38**	56***	40***

[1]Decimal Omitted

Table 4

Correlation of Measures of Advance Planning with Other Measures of Play Quality in Two Play Contexts

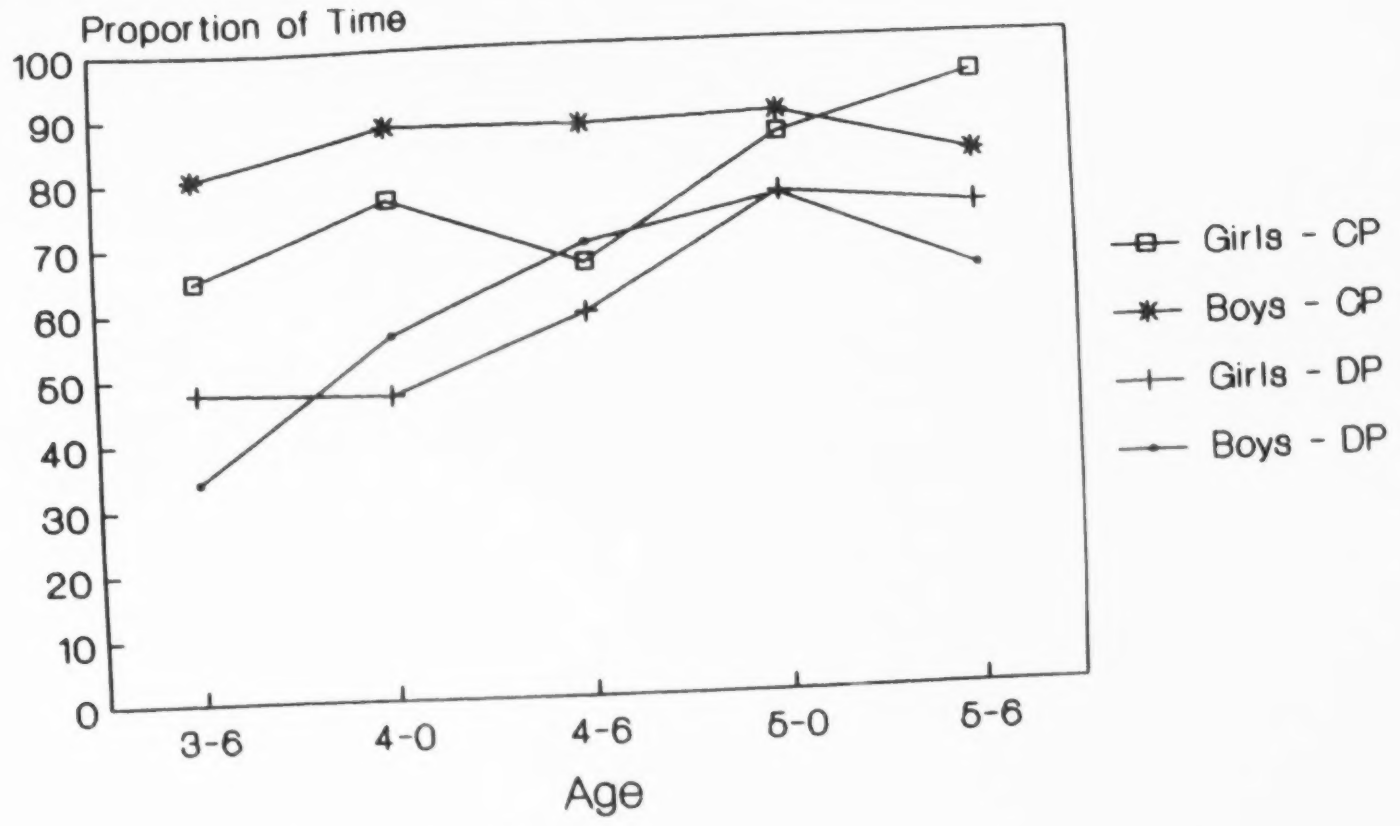
CP:	Adv. Plan.	.47***	.51***	.58***	.57***
	Verbal	.16	.12	.27**	.35***
	Non Verbal	.53***	.55***	.61***	.56***
DP:	Adv. Plan.	.70***	.60***	.71***	.74***
	Verbal	.52***	.45***	.53***	.57***
	Non Verbal	.72***	.63***	.73***	.76***

Table 5

Correlation Coefficients of MA with Parallel Measures from Dramatic Play (DP) and Constructive Play (CP) Sessions for Boys, Girls and Total Sample.

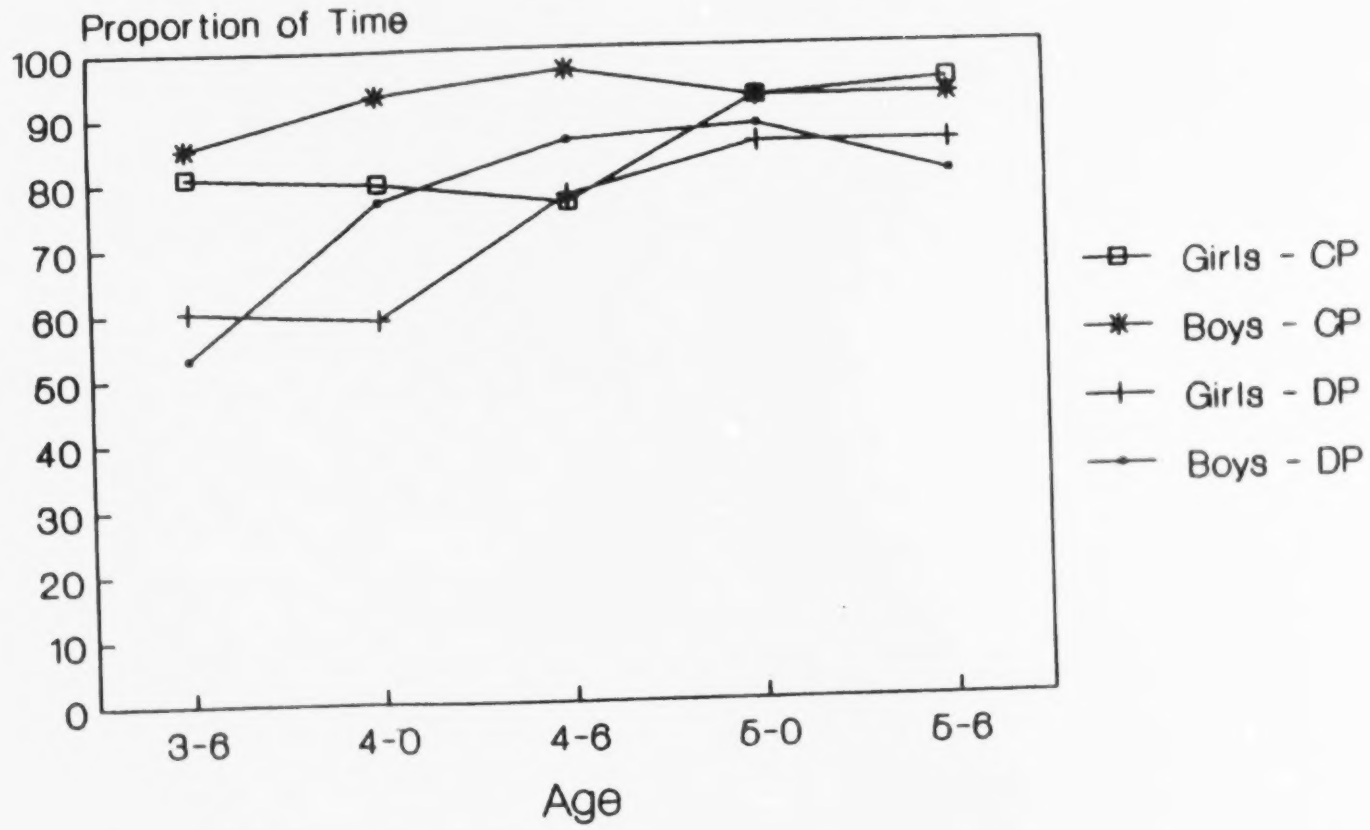
Measure	DP			CP		
	Boys	Girls	Total	Boys	Girls	Total
%Appropriate	52***	45***	47***	28*	46***	32***
Persistence	39**	48**	43***	14	57***	32***
Complexity	58***	56***	55***	51***	53***	50***
Coherence	69***	56***	61***	64***	60***	57***
Adv. Plan.	63***	47***	52***	60***	58***	47***
Non Ver. AP	59***	61***	56***	44***	58***	44***
Logical Order	59***	64***	56***	44***	55***	44***

[1]Decimal Omitted



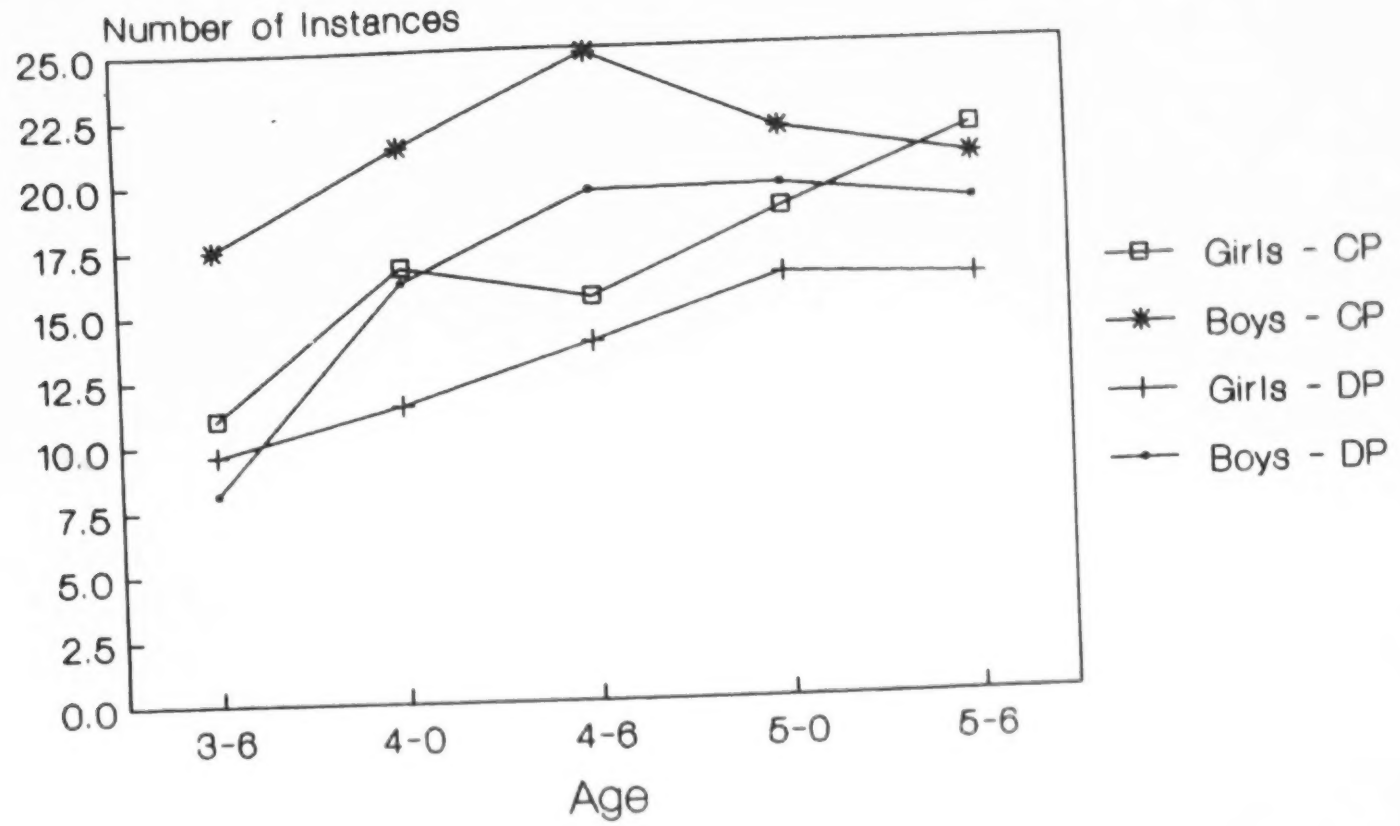
DP=Dramatic play;CP=Constructive play

Figure 2. Proportion of longest uninterrupted play episode engaged in play, persistence.



DP=dramatic play;CP=constructive play

Figure 1. Proportion of session spent in material-appropriate play, time on.



DP=Dramatic Play; CP=Constructive Play

Figure 3. Total number of instances of advance planning in session.

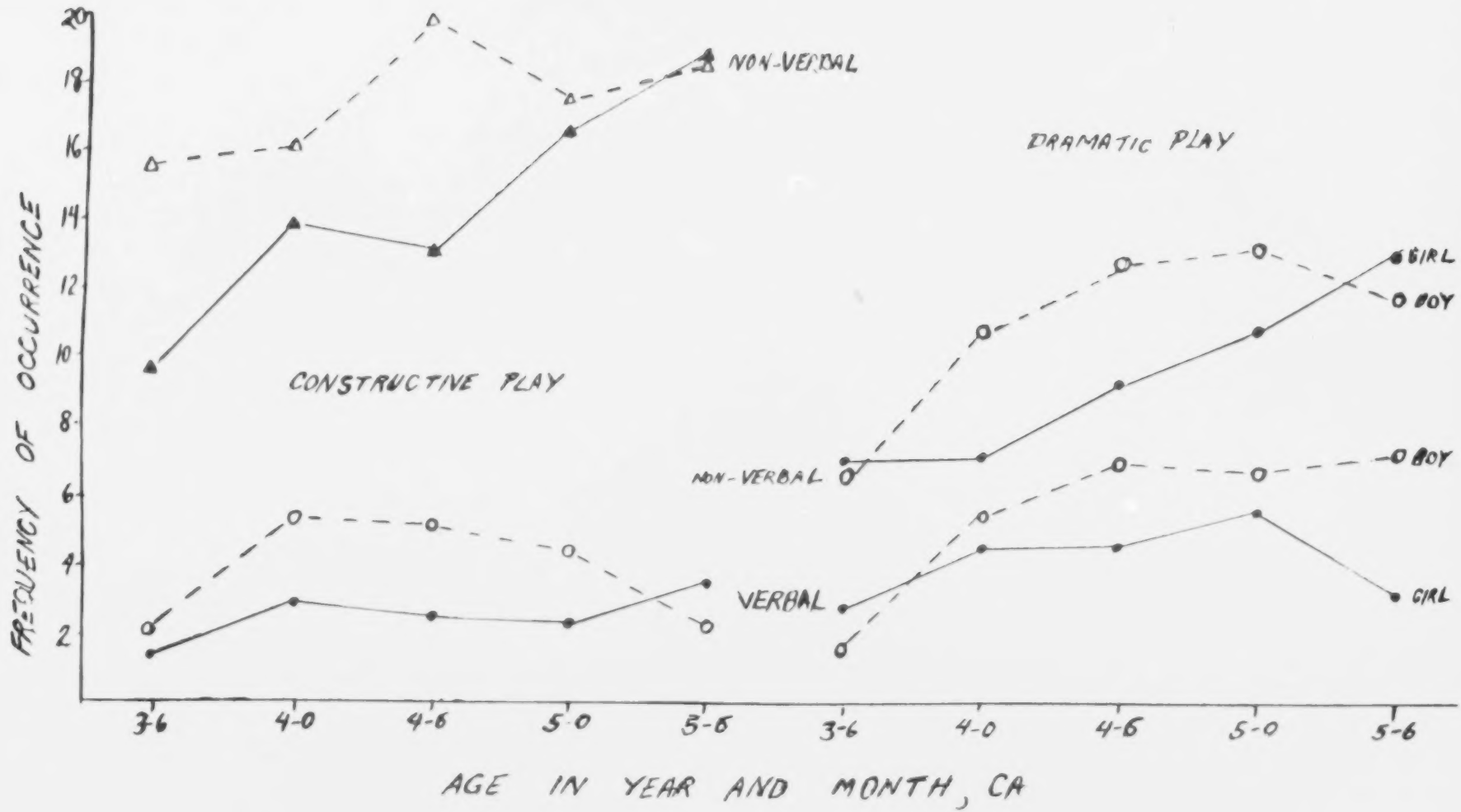


Figure 4. Number of verbal and of nonverbal instances of advance planning in constructive and dramatic play for boys and girls.